INSTRUCTIONS

FOR THE

TYPE 110-A QX-CHECKER

BOONTON RADIO CORPORATION
BOONTON, NEW JERSEY
U. S. A.

MP MASTER
MA24282

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SECTION I

GENERAL DESCRIPTION AND SPECIFICATIONS

The QX Checker consists essentially of an oscillator with its power supply, and a test circuit.

The oscillator supplies a constant voltage, adjustable in frequency and amplitude, to the test circuit.

The test circuit is a resonant circuit to which the test component is connected. The voltage across the test circuit is measured with a vacuum tube voltmeter. The variations in tuning capacitance to resonate the test circuit with various test components connected, indicate directly the relative variation in inductance or capacitance of the test component. Variations in the voltmeter reading at resonance indicate directly relative variations in Q of the test circuit and, in the case of coils, this is approximately the relative Q of the coil.

The general method of testing is a comparison of the test components with a standard component of the same type. Very accurate comparative measurements may be made because of the high stability of the QX Checker, although it does not measure absolute values of Q, inductance or capacitance.

OSCILLATOR FREQUENCY RANGE: 100 kilocycles to 25 megacycles in six ranges, using plug-in inductors. Six standard inductors are available which plug into the inductor socket (Fig. 1, #E) in the center of the QX Checker chassis. The entire group of six inductors covers the frequency range of 100 kilocycles to 25 megacycles as follows:

INDUCTOR TYPE	FREQUENCY RANGE
111-A 1	10 - 25 Megacycles
111-A 4	4 - 10 "
111-A12	1.5 - 4 "
*111-A22	500 - 1500 Kilocycles
*111-A27	300 - 900 "
111-A36	100 - 300 "

*One type 111-A22 and one type 111-A27 Inductor are normally supplied with each QX Checker. However, any two 111-A oscillator inductors will be supplied on request.

ACCURACY OF FREQUENCY CALIBRATION: Standard calibration curves are supplied for each inductor, accurate to approximately ±3%. (See back of this book.)

RANGE OF COIL CHECKS: Coils having inductance ranging between 1 microhenry and 10 millihenries may be checked or matched. The inductance compared is effective inductance. This is equivalent to a comparison of true inductance assuming that the distributed capacitances are equal.

ACCURACY OF COIL CHECKS: For coils having inductance of 10 microhenries to 10 millihenries and Q of 100 or greater, the inductance may be checked against the standard to within ±0.1% to ±0.2%. The accuracy of checking coils of less than 10 microhenries decreases with inductance.

RANGE OF CONDENSER CHECKS: The capacitance values of condensers ranging between 1 or 2 mmf and 1000 mmf may be checked against the standard by the direct substitution method with an accuracy of a few tenths of one mmf if the Q of the condensers is high. Condenser checks are generally more accurate at low frequencies such as used with the 112-A22 Condenser Unit.

POWER UNIT: The power unit incorporates a dual voltage transformer for operation on either 115 or 230 volts, 50-60 cycles. A "115-230" changeover switch with lock (Fig. 1, #S1) permits setting for the available power line source. A "Hi-Lo" switch (Fig. 1, #S4) is provided at the back, accessible from outside the QX Checker, to compensate for variations in nominal line voltage. Power consumption is 50 watts.

CAUTION: The proper power line voltage and frequency to correspond with the setting of the "115-230" switch must be used.

SECTION II

INSTALLATION AND OPERATION

UNPACKING: Before operating the type 110-A QX Checker, remove the corrugated board blocking placed over the tubes to prevent damage to them during shipment. The blocking is accessible upon releasing the two snapslides at the front of the cover, removing the six black screws attaching the cover to the cabinet, and lifting off the cover.

CAUTION: The power line frequency to be used must correspond to the data on the Q-X Checker nameplate. If not already at the proper setting, the "115-230" Volt Switch (Fig. 1, #S1) must be operated to the setting corresponding to the power line voltage available. This switch is provided with a lock to guard against accidental changes in setting. The "HI-LO" switch (Fig. 1, #S4), accessible from outside the Q-X Checker at the back, is to be set to "HI", except that it is to be set to "LO" for subnormal line voltages.

CAUTION: The QX Checker should be grounded as a protection to the sensitive voltmeter. A ground connection may be made to the right hand binding post on the front panel.

CAUTION: Be sure that any tubes replaced in the QX Checker are in the correct sockets. Failure to do this may result in damage to the QX Checker or tubes.

TUBES: Failure to operate properly is generally caused by defective tubes. The QX Checker is shipped with a complete set of tested and installed tubes which have operated correctly in the QX Checker before shipment. If, however, the QX Checker fails to operate properly the tubes should be replaced one by one with spare tubes of the correct type to locate any tube damaged during shipment.

The following tubes are used in the QX Checker:

IDENTIFICATION NO.	TYPE NUMBER	USE
V1	89	Oscillator
V2	BRC #101C	Voltmeter
V3	80	Rectifier
V4	874	Voltage Regulator
I1	Mazda 47 (6.3V.)	Pilot Lamp

All tubes except the pilot lamp are accessible by removing the six black screws at the back of cover and lifting off the cover. Reference to Figure 1 will identify their locations. The pilot lamp is accessible from the front of the instrument.

NOTE: The QX Checker will not operate unless the 874 voltage regulator tube (Fig. 1, #V4) is inserted in its socket.

CONTROLS: All the controls required for setting up the QX Checker to test a component are located inside the cabinet and are accessible upon releasing the two snapslides at the front of the cover and lifting the cover.

OSCILLATOR TUNING: The main oscillator tuning control (Fig. 1, #C2) is the knob and dial directly left of the oscillator inductor socket (Fig. 1, #E). A calibration chart for this dial with an accuracy of about 3%, is supplied for each oscillator inductor type 111-A furnished with the QX Checker. (See back of this book.)

A vernier oscillator tuning condenser is provided for accurately resonating the oscillator to the test circuit. This is the small knob in front of the main tuning control on the chassis. The marks "MIN" and "MAX" adjacent to this knob indicate the positions of minimum and maximum capacitance of this condenser.

OSCILLATOR OUTPUT: The output voltage from the oscillator is set by means of the left hand knob (Fig. 1, #R12) and the switch located on the baffle plate at the rear. The knob provides a gradual adjustment and the switch (Fig. 1, #S2) in the center of the baffle plate provides two ranges of output, the "HI" position being used for high outputs (required when testing low Q coils) and the "LO" position for low outputs (when testing high Q coils or components).

The type 89 oscillator tube (Fig. 1, #V1) is located on the left rear corner of the main chassis just behind the baffle plate.

VACUUM TUBE VOLTMETER: The small knob (Fig. 1, #R8) on the right side of the baffle plate adjusts the zero setting of the voltmeter. This seldom needs adjustment. This adjustment should be made after the tubes have warmed up for a few minutes, with a type 111-A oscillator inductor inserted in the oscillator inductor socket, and with a coil connected to the coil terminals on the front panel, but with the test circuit well detuned from the oscillator frequency.

The type 101-C voltmeter tube (Fig. 1, #V2) is located on the right rear corner of the main chassis just behind the baffle plate.

TEST CIRCUIT: The main tuning condenser (Fig. 1, #C4) of the test circuit is adjusted by means of the knob and dial located on the chassis directly to the right of the oscillator coil socket. This dial has two calibrations, the ±5 mmf capacitance calibration to be used when the 5 mmf vernier condenser is connected to the test circuit, and the ± 50 mmf capacitance calibration to be used when the 50 mmf vernier is connected.

The calibrations are correct when the vernier condenser (Fig. 1, #C3) is set to the zero position indicated on the dial on the front panel.

Between the main tuning condenser and the front panel is a plug connector which connects either the 5 mmf or the 50 mmf vernier condenser to the test circuit. The 5 mmf vernier is connected when the plug is inserted in the two jacks adjacent to the figure "5" on the chassis, and the 50 mmf vernier is connected when the plug is inserted in the two jacks adjacent to the figure "50".

FRONT PANEL CONTROL: The test circuit vernier condenser (Fig. 1, #C3) is located on the right side of the front panel and is operated by means of the large knob and pointer on the front of the panel. This is the only control used in testing components after making the necessary adjustments inside to set up for the particular test to be made. It is used to resonate the test circuit when the standard or test component is connected to the QX Checker.

The semi-circular dial plate is calibrated directly in micro-microfarads in two ranges, plus or minus 5 mmf and plus or minus 50 mmf. The plus or minus 5 range should be read when the 5 mmf condenser is connected to the test circuit by means of the plug connector inside the QX Checker and the plus or minus 50 range should be read when the 50 mmf condenser is connected.

The calibration of this dial is accurate to approximately 1 division.

> NOTE: THIS CALIBRATION REFERS TO THE COMPONENT BEING TESTED. THE DIAL READS + (HIGH) WHEN THE TEST COMPONENT IS HIGHER THAN THE STANDARD, EITHER IN INDUCTANCE OR CAPACITANCE, AND - (LOW) WHEN THE TEST COMPONENT IS LOWER THAN THE STANDARD.

The white outer portion of the dial plate is provided for marking testing limits. This surface may be written on with pencil and erased repeatedly.

METER: Resonance of the test circuit is indicated by maximum deflection of the meter (Fig. 1, #M1). At resonance the meter indicates approximately the relative Q of the test circuit. When testing coils the relative Q indication is essentially that of the coil, so that by setting the standard coil to read 100 on the meter (see OSCILLATOR OUTPUT adjustment page 4), the meter will indicate directly the percent variation in Q of the test coil from the standard.

In condenser tests the meter reading at resonance does not indicate directly the relative Q of the test condensers but it does indicate the effect of the losses in the condensers on the Q of the test circuit.

TERMINALS: Three binding posts are located on the front panel to which components to be tested are connected.

Coils to be tested are connected to the two left hand binding posts. The LOWER binding post is the LOW potential side and the UPPER binding post is the HIGH potential side of the coil. The RIGHT HAND binding post is grounded directly to the panel of the QX Checker.

A low impedance source of voltage is connected between the LOWER left hand binding post and the QX Checker panel, inside the QX Checker.

Condensers to be tested require a coil connected to the QX Checker for resonating the test circuit. The test condensers are then connected across the test circuit between the high potential coil terminal and ground. (See note page 6.)

COIL TESTS: The QX Checker is set up for testing coils as follows:

1. A standard coil is connected to the coil terminals of the QX Checker either directly or in a suitable fixture connected to the coil terminals.

2. The 5 mmf vernier condenser is connected to the test circuit by means of the connector plug inside the QX Checker, and the main Q tuning condenser (Fig. 1, #C4) set to a suitable total tuning capacitance, for example 200 mmf. The vernier condenser pointer is set exactly to zero.

3. A type 111-A Inductor is selected (by reference to calibration charts in back of this book) which will resonate to the test circuit frequency. The oscillator inductor is plugged into the inductor socket (Fig. 1, #E) and the oscillator frequency is adjusted by means of the oscillator tuning condenser (Fig. 1, #C2) to a region where further adjustment has no effect on the meter reading, i.e., the oscillator frequency is detuned from the test circuit frequency. The meter should now be adjusted to zero by means of the small knob (Fig. 1, #R8) on the right-hand side of the baffle plate. The oscillator frequency is next adjusted for resonance with the test circuit as indicated by maximum deflection of the meter. To obtain the correct deflection of the meter, the oscillator output is adjusted by means of the left hand knob (Fig. 1, #R12) on the baffle plate, using the switch (Fig. 1, #S2) to change the output range if necessary.

The frequency is then accurately adjusted to resonance with the oscillator vernier condenser (Fig. 1, #C1), and the oscillator output is adjusted until the meter reads 100. The test circuit vernier condenser (Fig. 1, #C3) should be varied slightly to check that resonance occurs at exactly 100 on the meter scale with the test circuit vernier at exactly zero. If necessary, frequency and output should be readjusted.

4. Test coils are connected in place of the standard and resonated with the test circuit vernier condenser (Fig. 1, #C3). Variations in inductance between the test coils and the standards are indicated on the vernier dial in mmf change in total tuning capacitance.

With the total tuning capacitance set at 200 mmf, as described above, the full scale variation of the vernier, plus or minus 5 mmf, is 2.5% of the total tuning capacitance. This corresponds to 2.5% variation in inductance of the test coil from the standard. 2 mmf then corresponds to 1% variation. If test limits of plus or minus 0.2% are desired, this corresponds to plus or minus 0.4 mmf on the vernier scale and marks may be made on the dial plate at plus 0.4 and at minus 0.4 mmf to indicate limits between which test coils must resonate.

If narrower limits are desired, the main Q tuning condenser may be set to 400 mmf. Then 4 mmf on the vernier condenser scale corresponds to 1% variation in inductance, and 0.4 mmf corresponds to 0.1% variation in inductance.

If wider test limits are desired the total circuit capacitance may be set at 100 mmf, or the 50 mmf vernier condenser may be used instead of the 5 mmf vernier.

The meter reading at resonance indicates directly the relative Q of the test coil as compared to the standard coil, in percent, when the standard coil reading is 100. This is accurate for small differences (plus or minus 10 to 20 percent), but will be less accurate for large differences. The accuracy is also reduced for coils having inductance of less than 10 microhenries.

CONDENSER TESTS: A coil is required to resonate the test circuit for all condenser tests. This coil is connected to the coil terminals on the front panel, and the test condensers are connected from the high potential coil terminal to ground (panel).

NOTE: The type 112-A22 Condenser Unit is designed for testing small condensers up to about 1000 mmf in capacitance. It is a completely shielded high Q coil of approximately 250 microhenries inductance which plugs into the terminals of the QX Checker and may be screwed on permanently if desired. Condensers to be tested are connected to terminals on the front of the 112-A22 Condenser Unit. The frequency range when using the 112-A22 is from 300 kc to 1300 kc depending on the capacitance under test.

To set up for condenser tests, the same general procedure is followed as described for coil tests, except that a standard condenser is connected across the test circuit (or to the condenser unit) before resonating the oscillator to the test circuit. Greatest accuracy is generally obtained when the main tuning condenser is set to a low value.

Variations of test condensers from the standard condenser may be read directly in mmf on the vernier condenser scale or limits may be marked on the dial plate at some fixed percentage of the standard condenser capacitance.

For example: It is desired to test a group of condensers holding them to within plus or minus 2 per cent of a standard condenser having a capacitance of 100 mmf. The QX Checker is resonated with the standard condenser connected, and with the 5 mmf vernier connected to the test circuit and set exactly at 0. Two per cent of the standard condenser is 2 mmf, so limits are marked at plus 2 and minus 2 mmf on the vernier dial plate. Test condensers, when connected in place of the standard, must resonate within the limits marked, to be within plus or minus 2 per cent of the standard.

When testing larger condensers the 50 mmf vernier condenser may be used which permits testing condensers up to about 1000 mmf capacitance with a plus or minus 5%, or smaller, variation, and condensers up to 500 mmf with a plus or minus 10%, or smaller, variation.

The meter reading at resonance may be used as an indication of losses in the test condensers although it does not indicate directly the Q of the condensers. If standard condensers are available having values of Q at which it is desired to set limits, they may be connected to the QX Checker to obtain meter readings corresponding to the values of Q desired and these meter readings used for test limits.

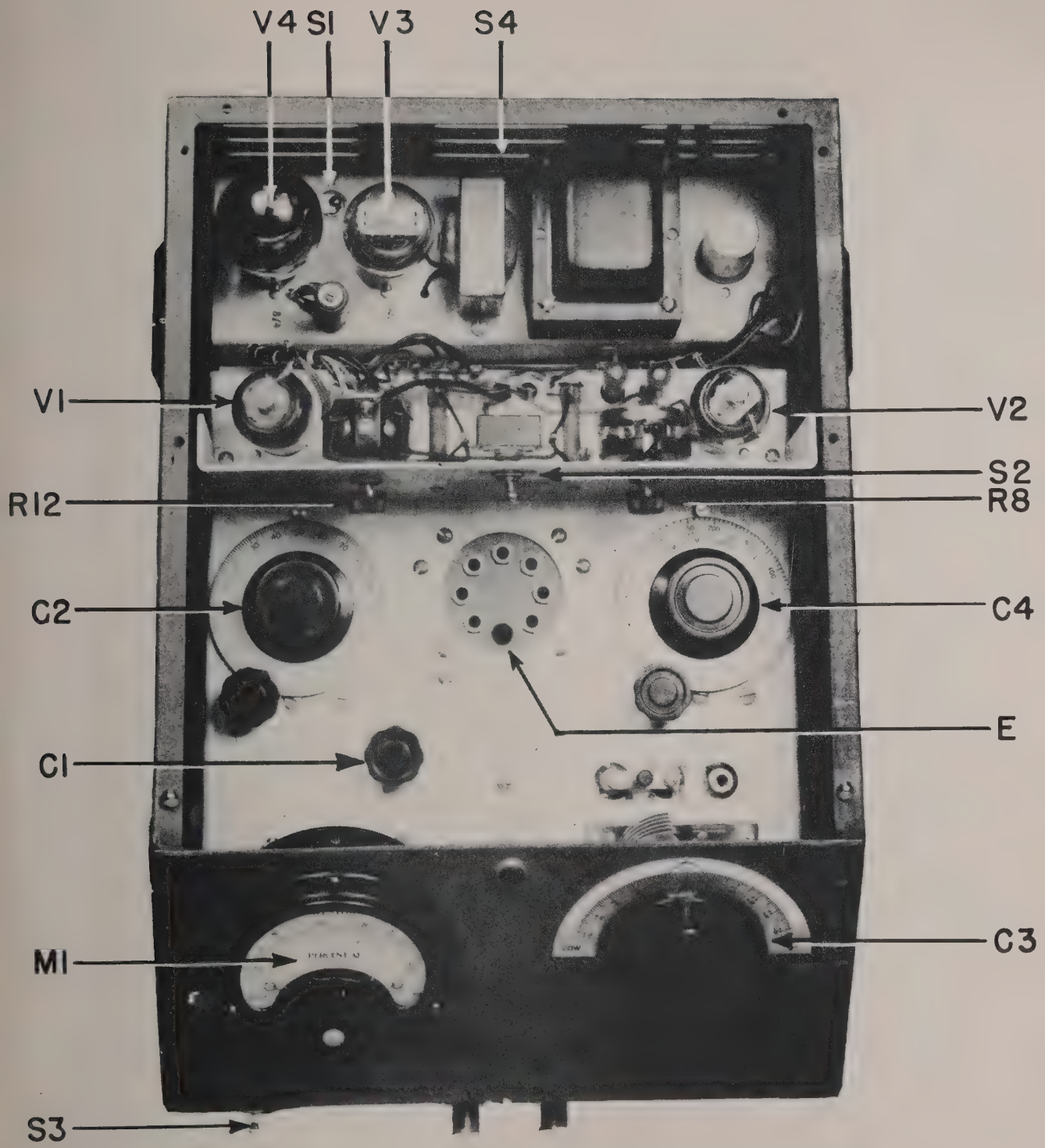
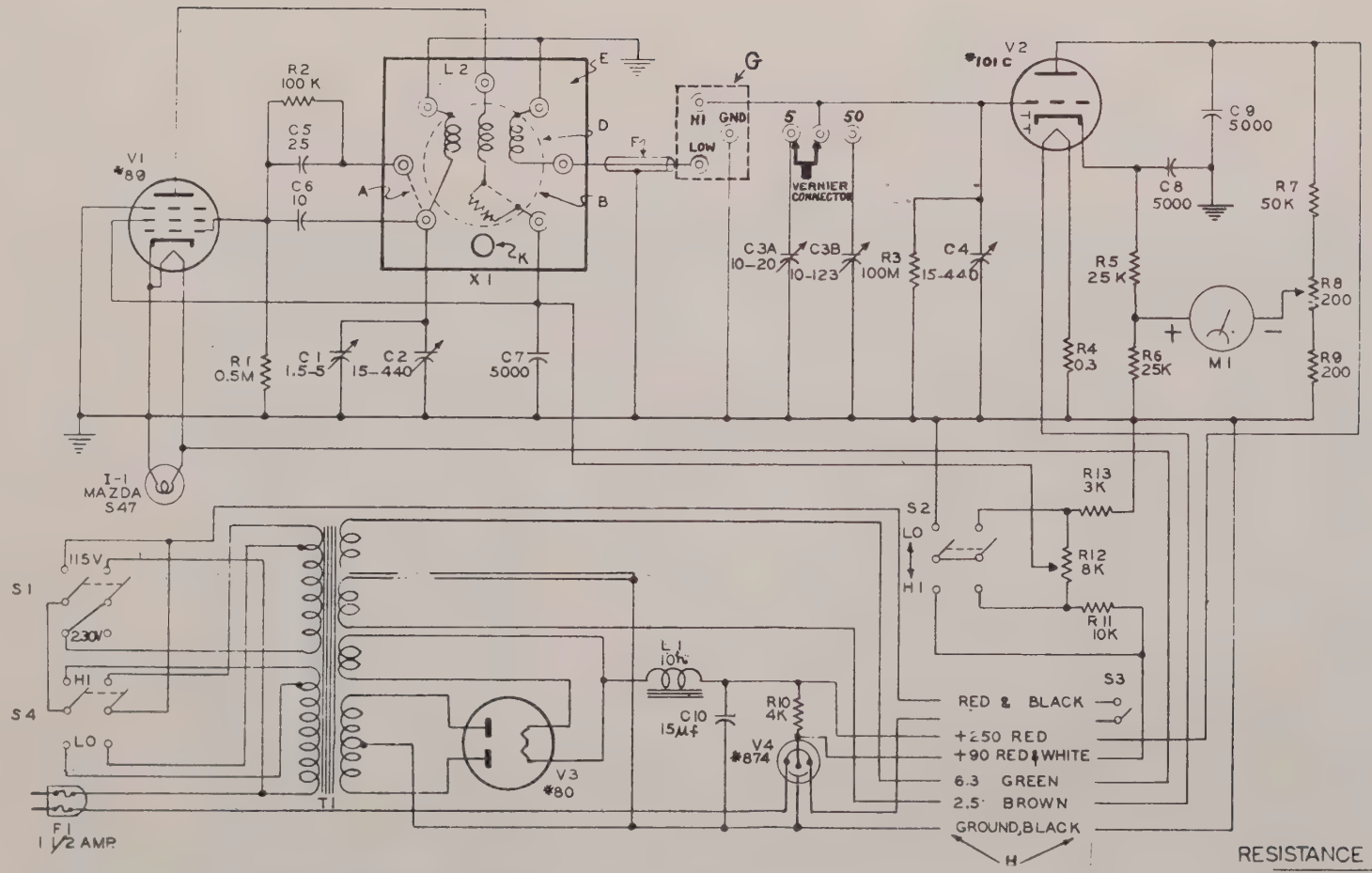


FIG. 1



A - STRAIGHT DASHED LINE CONNECTION MADE ON SOME FREQUENCY RANGES.
B - RESISTOR IN CIRCUIT ON SOME FREQUENCY RANGES.
D - OSCILLATOR INDUCTOR SHIELD.
E - TOP VIEW OF TYPE 111-A INDUCTOR SOCKET, ILLUSTRATING CONNECTIONS MADE WHEN INDUCTOR IS PLUGGED IN.
F - SHIELDED CABLE.
G - FRONT VIEW OF FRONT PANEL TERMINALS.
H - TERMINAL STRIPS ON POWER UNIT AND MAIN CHASSIS WITH CABLE COLOR CODING.
K - GUIDE FOR INSERTING TYPE 111-A OSCILLATOR INDUCTORS.

RESISTANCE IN OHMS

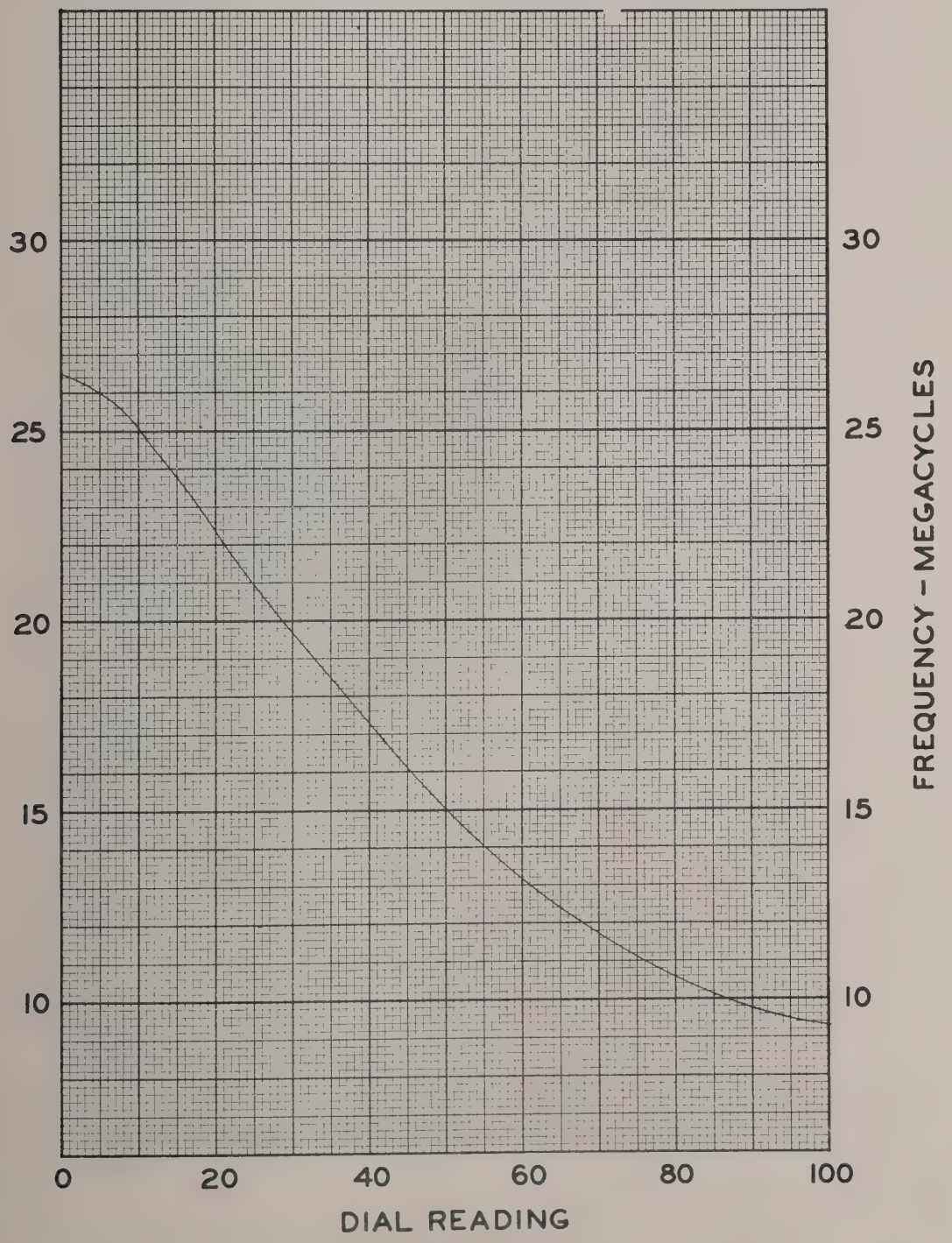
K = 1000
M = ONE MEGOHM
CAPACITANCES IN μμf
EXCEPT WHERE OTHERWISE SPECIFIED.

110-A SCHEMATIC

FIG. 2

TYPE III-A1
OSCILLATOR INDUCTOR

FREQUENCY
10—25 MC

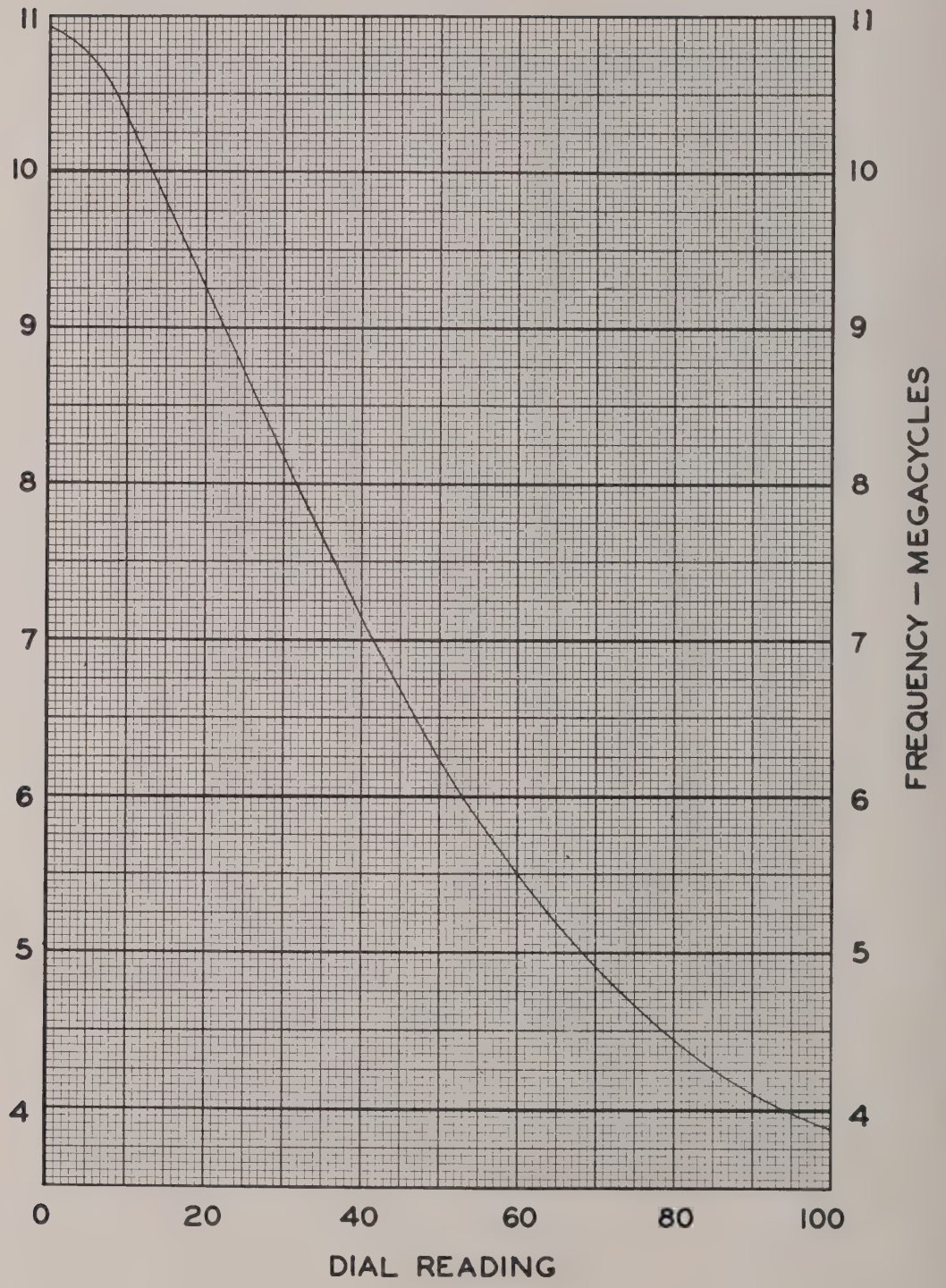


DRWG. NO. S-6002

K & E CO., N.Y.
42875

TYPE 111-A4
OSCILLATOR INDUCTOR

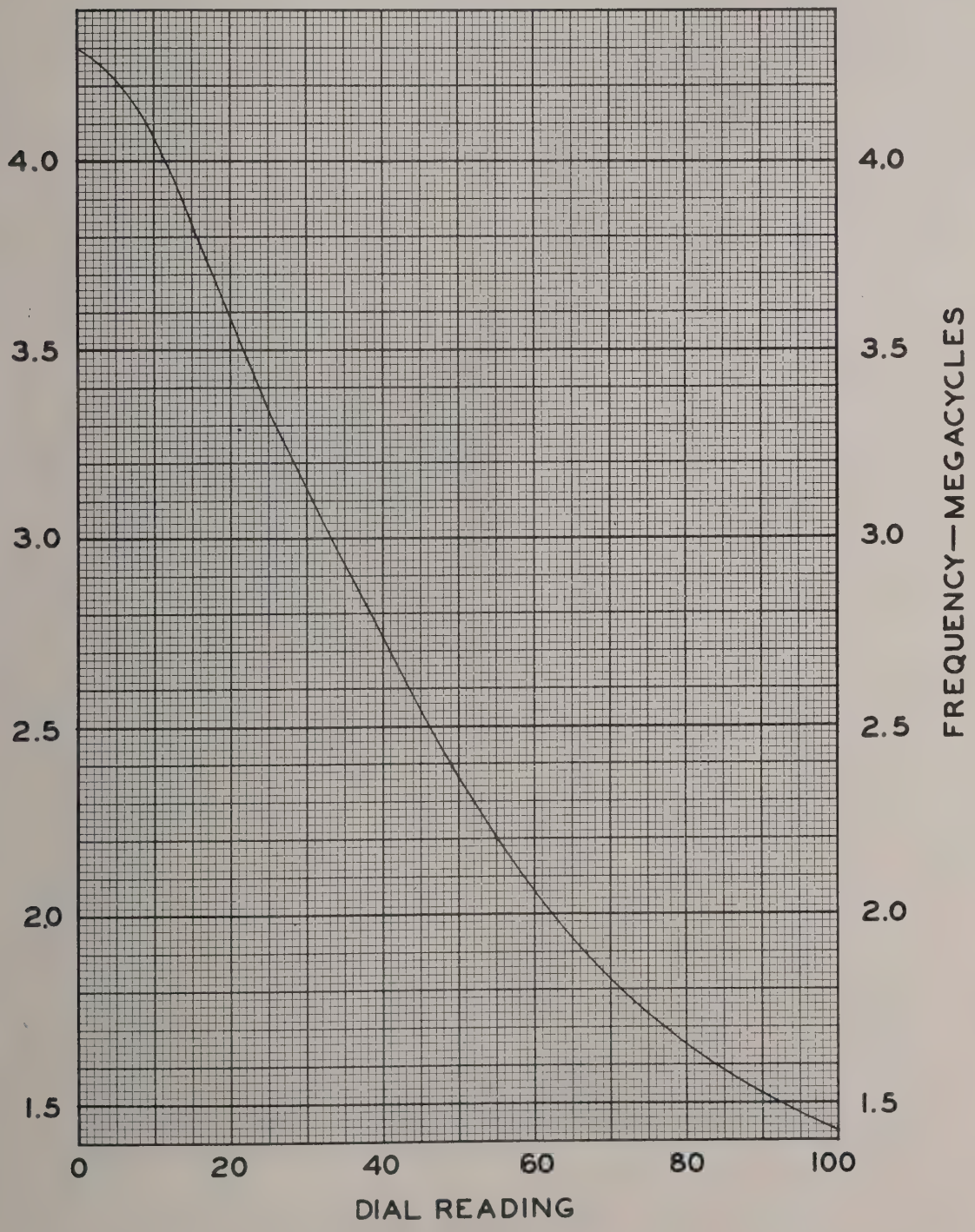
FREQUENCY
4 — 10 MC



DRWG. NO. S-6003

TYPE 111-A12
OSCILLATOR INDUCTOR

FREQUENCY
1.5—4 MC



DRWG. NO. S-6004

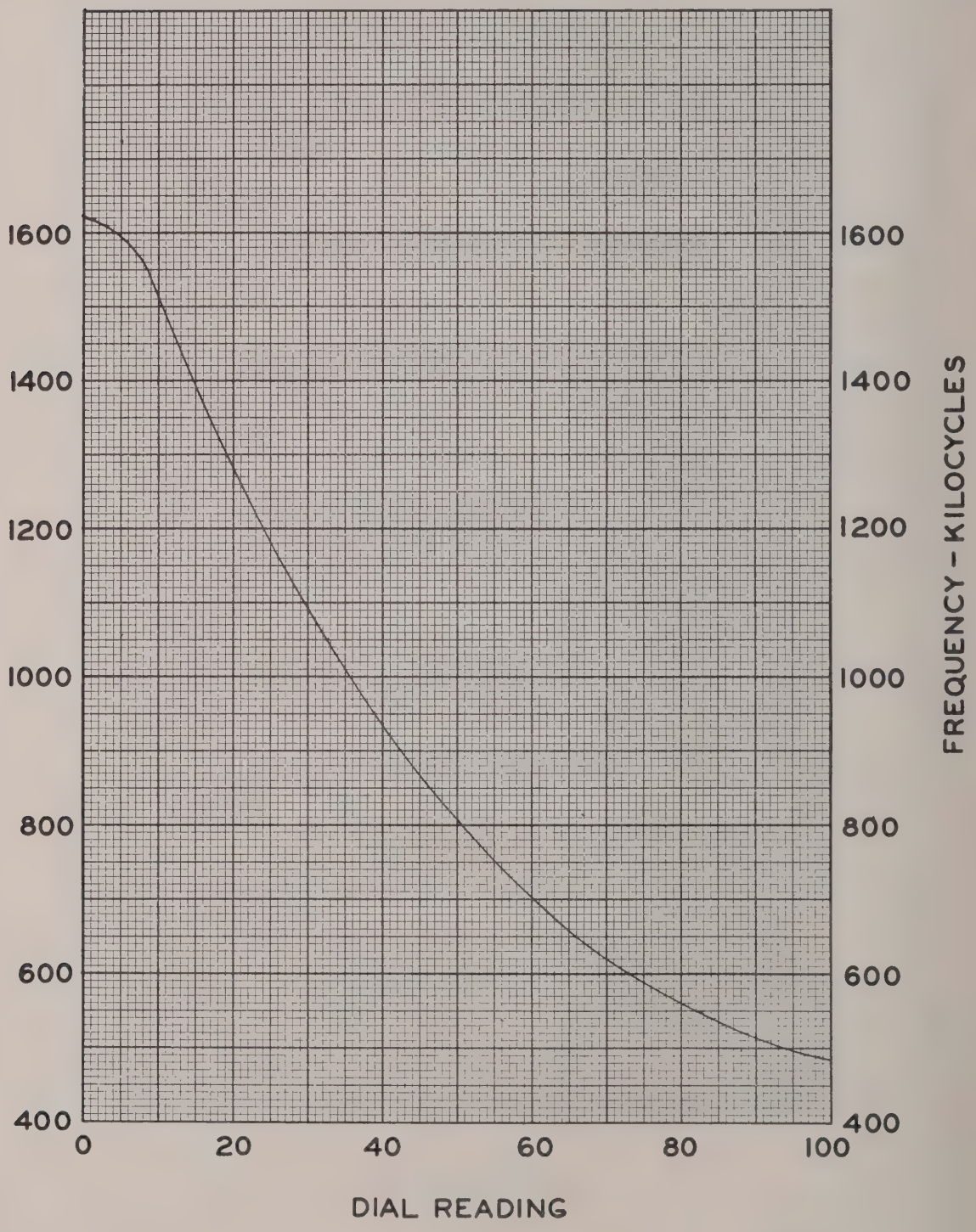
K & E CO. N.Y.

TYPE 111-A22

OSCILLATOR INDUCTOR

FREQUENCY

500 — 1500 KC



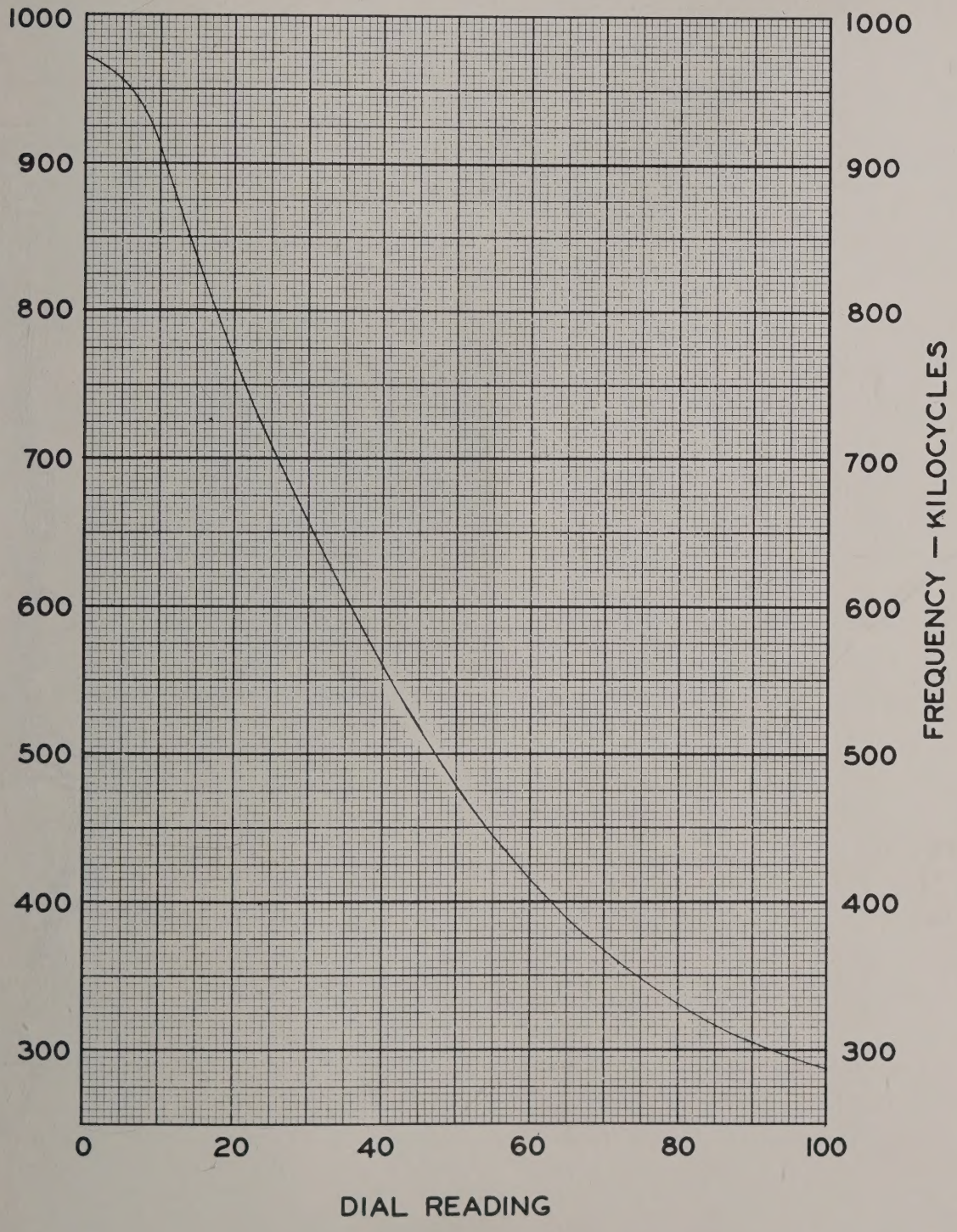
DRWG. NO. S-6005

TYPE III-A 27

OSCILLATOR INDUCTOR

FREQUENCY

300 – 900 KC



DRWG. NO. S-6006

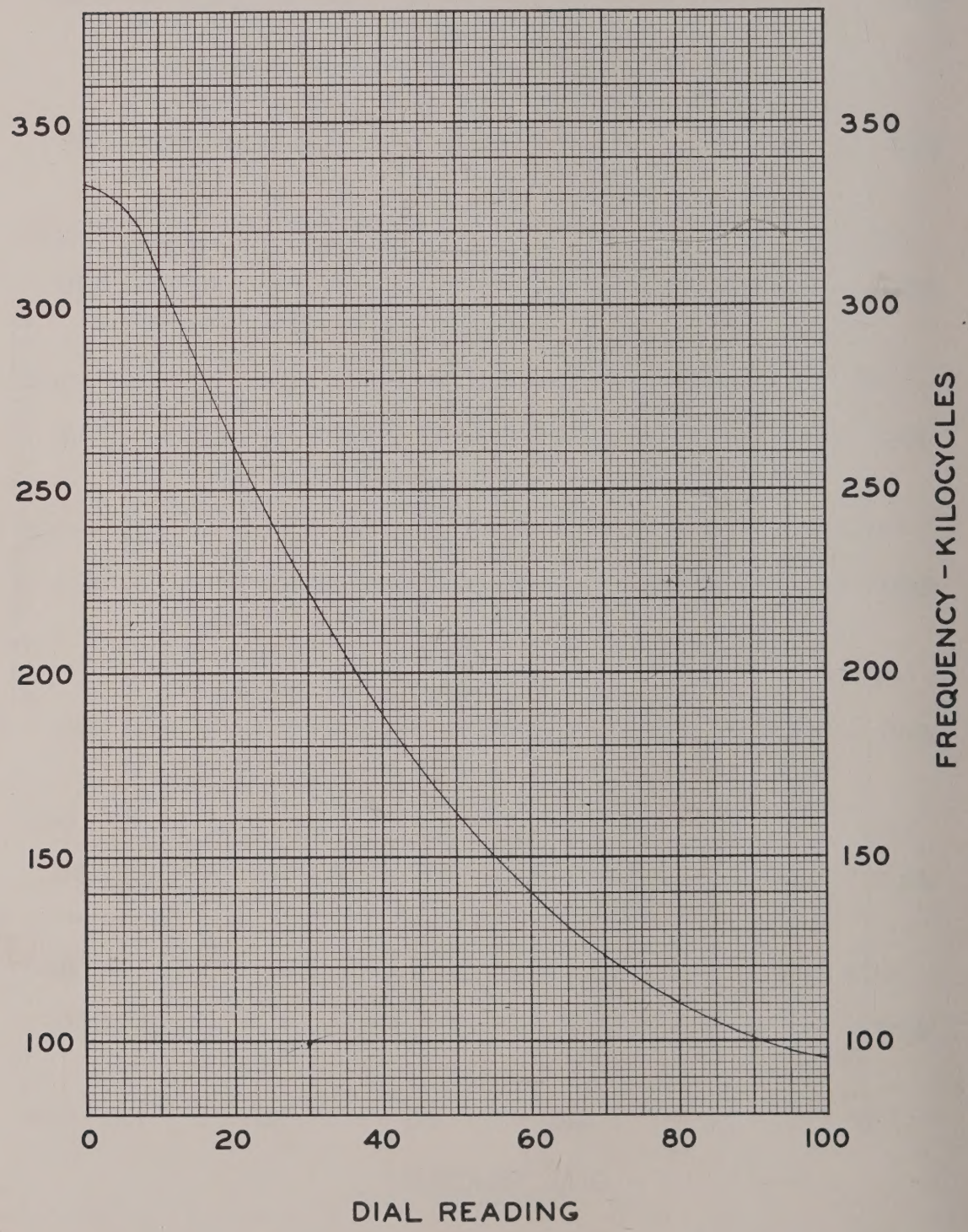
K & E CO., N. Y.

TYPE 111-A36

OSCILLATOR INDUCTOR

FREQUENCY

100—300 KC



DRWG. NO. S-6007

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